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(1)

A STUDY OF SOME CASTS OF THE INFANTILE PHARYNX.

WITH SPECIAL REFERENCE TO THE EUSTACHIAN TUBE.

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(2)

A NOTE ON EUSTACHIAN OBSTRUCTION.

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(3)

PARTIAL BIBLIOGRAPHY OF RECENT PAPERS RELATING TO THE EUSTACHIAN TUBE.

BY

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BROOKLYN, N. Y.

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A STUDY OF SOME CASTS OF THE INFANTILE PHARYNX WITH SPECIAL REFERENCE TO THE EUSTACHIAN TUBES.

By WILLIAM C. BRAISLIN, M. D., Brooklyn, N. Y.

The very considerable differences in relative size and shape between the pharyngeal cavity of infancy and of adult life form the basis for the following remarks:

Casts of metal or plaster are found useful in demonstrating the topography of this region. For purposes of photography those of the latter material, though more fragile, have superior advantages.

The photographs accompanying this paper were made from casts of fresh uninjected material as well as from specimens hardened in formalin solution. In order to demonstrate certain details, photographs of the tissues themselves have also been used.

The naso or rhino-pharynx is generally understood to include that portion of the respiratory tract posterior to the nares and above the level of the soft palate. It is so treated here. This tract is meant in all mention of the pharynx, naso-pharynx or rhino-pharynx in the present paper.

An examination of the pharynx of the new-born reveals a cavity with its long axis in the horizontal, rather than the vertical plane as in the adult. The long diameter of the infantile pharynx is antero-posterior rather than supero-inferior. The cavity is relatively low and elongated, wide and flattened from above downward, approaching more nearly the shape of certain mammalia of a lower type than that of the human adult. The roof or vault of the infantile pharynx is nearly rectangular. On its surface is distributed the pad of lymphoid glandular tissue arranged in rather

prominent folds. The folds diverge as from a centre, the outer ones to the full width of the roof, and again converge toward the posterior edge of the nasal septum.

The pattern is fairly regular, though by no means constant. The rugae are distinctly visible in all the new-born specimens studied except in one very much emaciated child, where the vault was perfectly smooth and free from rugae. In fat infants they seem more than usually prominent. They have been noted well developed in the seven-months

FIG. 1.

Naso-pharynx of new born, its long axis more nearly horizontal than in the adult. The post-septal border is also more nearly horizontal than that of the adult. (Slightly reduced.)

embryo and may often doubtless be visible, even on gross dissection, earlier. These folds usually retain their characteristic pattern when hypertrophied (adenoids), and are often thus removed. Masses taken away by the sharp curette, especially, frequently exhibit the characteristically shaped rugae, with deep creases between. At the centre of the pharynx where the folds converge in four of my speci-

mens was seen a somewhat duct-like opening (the pharyngeal bursa*).

Behind the pad of glandular tissue which in the new-born extends but little posteriorily to the center of the roof of the pharynx, the mucous membrane is smoothly continuous with that lining the posterior and side walls. This portion of the mucous membrane after preservation in formalin solution, assumes fine transverse rugae in both infants and adults, being occasioned doubtless by the contraction of the fibres of the superior constrictor muscle. The anterior wall, composed of the posterior nares and septum differs

FIG. 2.

Casts of new-born pharynges, superior aspects. In left cast the rugae are regular, in right (cast prolonged into posterior nares) the rugae are irregular.

from the adult in the following particulars. The posterior nares are wider and shallower, approaching in shape a pair of equilateral triangles placed on their bases, side by side, the septum like a widely spread V between them. (See fig. 4).

The infantile post-septal border arches very gradually from the horizontal plane at its superior attachment until near its inferior attachment when it suddenly angles down-

* Openings of this character may sometimes be observed in older children elsewhere in the pharynx. The writer has seen a case where several such openings were visible in a youth of seventeen years apparently as a result of inflammatory changes in unoperated adenoids.

ward to the articulation with the horizontal plates of the palate bones.

The lateral walls in infancy show perhaps the widest differences from the adult of any of its boundaries, exhibiting the characteristics of this shallow, and relatively long cavity. The most conspicuous landmarks are the prominences of the cartilaginous extremities of the Eustachian tubes which stand out sharply from the side walls, separating the depression of the pharyngeal mouth of the tube in front from that of the longer, more extensive and equally deep depression, forming the fossa of Rosenmüller, behind. The prominences of the cartilage receive the direct impingement of the air current, inspired through the nares and in some degree deflect it across the mouths of the tubes

FIG. 3.

Cast of new-born naso-pharynx, lateral and superior surfaces. T are the projections into mouths of Eustachian tubes. R of Rosenmüller's fossae. Elongated projections at left ends of cast are the extensions into the posterior nares, and indentations at the extremities of these are made by the posterior ends of the lower and middle turbinated bodies.

below, and against the roof of glandular tissue above. In the new-born the Eustachian cartilages are crowded closely to the roof of the naso-pharynx. They narrow the cavity somewhat from side to side. Anteriorly to, and below, the cartilaginous prominences, at the depressions of the mouths of the tubes and behind and above them (fossæ of Rosenmüller), the cavity of the infantile naso-pharynx reaches its extreme width. The depressions created by the mouths of the tubes considerably widen its transverse diameter at this

point, and this is likewise the part of the naso-pharyngeal cavity of the least vertical diameter.

The mouths of the tube lie, relatively to the septum, more posteriorily in the infant than in the adult. Instead of being on a direct plane with the septal edge as in the adult they are ⅛ inch posterior to it. This discrepancy is due to the lesser development of the vomer in the new-born.

Traces of the salpingo-pharyngeal and the salpingo-palatine folds, one or both, may be noticed in the infantile pharynx. These follow the long axis of the cavity in both

FIG. 4.

Transverse vertical section just anterior to opening of posterior nares showing their triangular appearance.

cases so that they extend more nearly horizontally in the new-born than, as in the adult, vertically.

The mouths of the Eustachian tube are relatively more nearly on a level with the floor of the nares than in the adult. They are bounded above by the prominences of the Eustachian cartilages while the lower lip merges into the floor of the cavity (soft palate). The muscles underlying the mucous membrane at this point, the levator and tensor

palati, are both relatively well developed; both, however, taking more nearly horizontal than vertical directions than in the adult, from origins to attachments, due, in part, to the lack of development of the pterygoid processes of the sphenoid and to the inferior depth of the cavity of the naso-pharynx in the infant.

The floor of the pharynx of the new-born compares closely with that of the adult. Its palatal portion is of greater diameter, antero-posteriorly. This is due to the vomer being relatively smaller and more anteriorly placed in the infant and the hard plate likewise relatively shorter, antero-posteriorly.

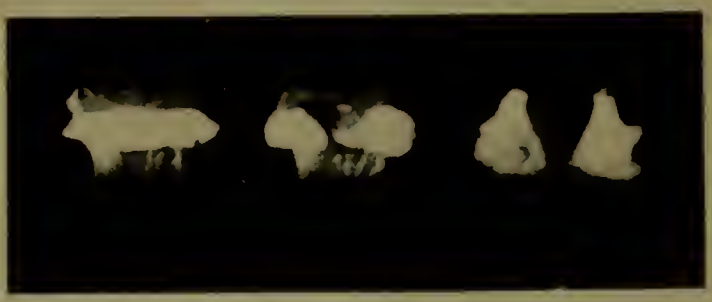

FIG. 5.

Vertical cross-sections through three casts of naso-pharynx of new-born (slightly enlarged). Figure on the left, at plane of mouths of Eustachian tubes; middle figure, at plane of posterior edge of septum; figure at right represents a cross-section within posterior nares.

The differences in the form of the infantile and adult naso-pharynx depend directly and primarily on the bony framework of the surrounding structures so that it is necessary to refer briefly to these, in order to elucidate the main causes of differences of the size and shape of the naso-pharyngeal cavity of the new-born.

The sphenoid bone presents at birth little evidence of the subsequently marked development of the pterygoid processes of the adult. The vertical plates of the palate bones are likewise very short. The vomer, which in adult life extends its superior articulation to the posterior edge of the

body of the sphenoid, articulates in the new-born with only the anterior half of the inferior surface of the sphenoid, in other words, it is relatively as well as actually smaller in the infant. The ethmoid, together with the bones of the face, have yet to undergo the development which increases so greatly the nasal mucous surface.

FIG. 6.

Cross-section of the pharyngeal mouth of the Eustachian tube. The darker tissue (enlarged 7 diameters). Author's specimen. The line of darker tissue at the left shows the Eustachian cartilage divided at its anterior, free, extremity.

The superior maxillary bones including the hard palate (palate processes) are relatively small.

In the new-born the nares are apparently of inferior relative importance, while the pharynx from its greater length

appears to be of relatively superior importance. It seems probable that in infancy a greater relative amount of the function of warming and moistening the respiratory stream is performed by the pharyngeal mucous and lymphoid tissues than by the nasal surfaces.

FIG. 7.

Cross-section of the tube, 2 cm. from pharyngeal mouth. Shows folds of mucous membrane within tube and relation to tensor muscles. Kindly photographed from the author's specimen by Dr. Edward L. Oatman. (Highly magnified.)

The dimensions of the infantile naso-pharynx (from the average measurements of my series of casts of twelve specimens) are, width at fossae of Rosenmüller and also at Eustachian tube mouths, 1.4 cm. (½ inch), depth, at plane of tubal orifices .4 cm. (3-16 inch) to .8 cm. (¼ inch) or

greater, posteriorly, as the floor, following the curve of the soft palate, descends. The horizontal portion of the vault is 1.5 cm. (⅝ inch) antero-posteriorly, and posteriorly, as it gradually curves downward into the posterior pharyngeal wall, the distance is as much greater. The horizontal portion of the floor of the naso-pharynx (upper surface of soft palate) is relatively longer, as the hard palate (palate

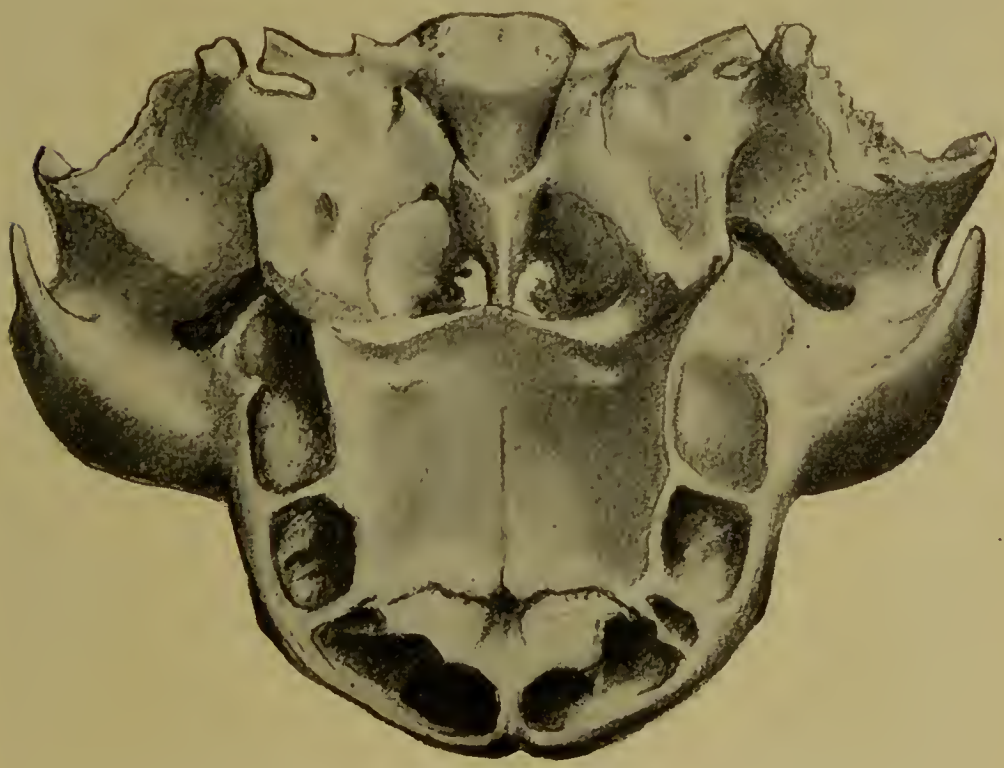

FIG. 8.

Sphenoid, superior maxillary and palate bones of infant. Inferior development of pterygoid processes and of vomer as compared with same structures in the adult. Drawing made for writer from specimen loaned by Dr. H. Von W. Schulte. Almost twice nat. size.

process of the superior maxillary) is relatively short, in the new-born than in the adult.

The antero-posterior attachment of the vomer to the body of the sphenoid in the adult extends nearly or quite, to the posterior edge of body of sphenoid. In infants, it extends

across about ½ the body of the sphenoid, and the vaginal processes of the sphenoid do not enclose the vomer.

The shallow pharynx of the infant under five years, especially under three years, makes the use of any but specially adapted forceps for the removal of adenoids less applicable than in older children and adults. I believe that a curette is preferably employed, and as a result of experience, I think this should be broad, rather flat-bladed and quite sharp. If the blade is dull, little good will be accomplished and partly detached portions of the growth may remain.

The writer wishes to acknowledge his indebtedness to Dr. Jonathan Wright, Dr. C. Schradieck, Dr. E. L. Oatman, and others, for generous assistance rendered in the preparation of this paper.

Conclusions.

1. The naso-pharynx of the new-born is low, broad and relatively long. Its shallowness is due to the undeveloped state of the bones of the cranium, face and cervical vertebrae chiefly the pterygoid processes of the sphenoid, the palate bones, the palate processes of the superior maxillary bones (hard palate) and of the vomer.

2. The inferior development of the nasal cavities may be responsible for a transference of greater relative respiratory importance upon the pharyngeal tissues. This may perhaps account in part at least for the lymphoid tissue of the infant being the seat of a relatively greater degree of hypertrophy than in the adult. As age advances the growth of the bones of the cranium and face is very rapid, the vault of the naso-pharynx becoming higher.

In adult life the vault is higher and apparently more withdrawn from the direct air current, although if the tissues remain normal, the functions of warming and moistening the inspired air are here still in part performed.

3. The difference in structure of the naso-pharynx of the young infant indicates a somewhat different course of procedure in operations for the removal of adenoids. In infants of two or three years or younger, adenoid forceps are rarely applicable. It is believed that in children under five years, a Gottstein's curette or some modification of it, is preferable. A sharp, flat bladed and fairly wide instrument best meets the indication in the hand of the writer.

A NOTE ON EUSTACHIAN OBSTRUCTION.

By WILLIAM C. BRAISLIN, M. D., Brooklyn, N. Y.

The following note is the result of an effort on the part of the writer to differentiate obstruction or inflammation of the Eustachian tube from concurrent inflammation of the tympanic cavity. This naturally led to a careful inquiry from patients as to the presence of purely tubal symptoms in all kinds of ear diseases. Some of the conclusions reached, having proved of interest to the writer, are recorded.

Absolute occlusion of the tube is believed to be of extreme rarity. It is very much open to question whether those tubes which on Politzeration seem impermeable are entirely so. Bezold stated (1895) that he had not met with atresia of the tube in his autopsies.

In almost all cases of acute pharyngitis (and rhinitis) the mouths of the tubes are at least congested; they may be oedematous, and active inflammation may extend along their lining membrane. In lymphoid tissue hypertrophies, the tubes are more or less obstructed.

It is a matter of common observation in examining the ears of patients suffering with an ordinary "head-cold" to find that there is more or less congestion of the ear, noticeable in a diminution of the lustre of the membrana tympani. In these cases all subjective symptoms referable to the ears or tubes may be absent.

The Eustachian tube as a drainage way. The patency of the tube is usually sufficient to allow fluids, as blood, pus or serum to drain from the middle ear into the naso-pharynx. For example, the passage of blood into the throat and thence into the stomach is frequently noticed at operations on the mastoid, especially in the radical operation when the mucous membrane of the middle ear is freely curetted.

The Eustachian tube as a transmitter of sound. The tuning fork held in the open mouth is heard more distinctly in normal ears than when in front of the nostrils or the closed mouth, but not as distinctly as when held near the ear. Nor is the hearing of a fork held in the mouth increased when the external ears are held closed. A tuning fork held in front of the nostrils is not heard longer than when held at the back of the head.

The fact that a tuning fork held in the open mouth is heard longer and louder than when it is held in front of normally patent nostrils, does not indicate that sound waves travel through the tube more readily by this route, but that sonorous impressions are thus more directly transmitted to the bones of the head and their enclosed air spaces, and are thus by direct vibration transferred to the hearing organ.

A curious instance of voluntary deflation of the middle-ear occurred in the case of a physician recently treated, who had normal hearing. In childhood he found that he was able to diminish the intensity of loud sounds which were disagreeable to him, by a voluntary act performed thus: The act of yawning was simulated, but without opening the mouth. Then an indrawing of the breath resulted in a rarefication of the intratympanic atmosphere, causing the drum membrane to be drawn against the inner wall of the cavity, with resulting diminution of all auditory perceptions. In order to restore the hearing to normal the act was varied by contraction of the tensor muscles as before and by then auto-inflating the tubes.

Symptomatology. In early inflammations of the tubes with beginning obstruction, also, after the subsidence of more pronounced obstructions, and in many chronic forms of ear diseases as well, the symptom of the occurrence of a snapping sound in the ears on swallowing or on blowing the nose, is present. The presence of this symptom always means a definite condition, and is a certain indication of partial tubal obstruction. It means that there is a partial obstruction of the tube, but one easily overcome. The mere

contraction of the tensor and levator palati opens the tube sufficiently to restore wholly or partially to normal the atmosphere of the tympanic cavity. Though there may be some difference of opinion as to the exact cause of this snapping sound on swallowing, I believe it is chiefly due to the drawing apart of the walls of the tube through a greater or less part of its length by the contraction of the tensor and levator palati muscles.

In severe phases of obstruction of the tube no snapping sound occurs on swallowing or on moderate blowing of the nose. Severe blowing, autoinflation, Politzerization or catherterization may however momentarily restore the atmospheric balance. In the most severe forms of obstruction all these fail. Astringents applied to the pharyngeal mouths of the tube may aid in restoring the balance.

On investigating this phase of middle ear disease, I have been surprised, though it may not surprise others, to find how common is the occurrence of the loud, snapping sound referred to, in one or both ears, in various forms of chronic middle ear diseases, as in chronic catarrh and in the so-called mixed, middle and internal ear disease. I believe that inflammation of the tube alone may occur without involvement of the other parts of the ear as stated above; but, that more or less active inflammatory processes in the Eustachian tube co-exist with a large proportion of the non-suppurative ear diseases daily met with, may be inferred, from the frequent presence of symptoms referable to the tubes themselves. The following symptoms are more or less significant.

Snapping. A swelling of moderate or severe degree of the mucous membrane lining the tube impedes the passage of air into the tympanic cavity, where an apparently rapid absorption of air into the circulation is constantly occurring. Very mild degrees of obstruction are relieved by swallowing or pushing forward the lower jaw. When this occurs a sound, similar to that of the separation of the moistened finger and thumb, held in front of the meatus, is perceived.

This snapping sound made by the opening of the tube is heard more intensely when the swollen walls of the tube separate on blowing the nose or on autoinflation. In nearly all acute forms of ear diseases this symptom is more or less prominent and it also commonly accompanies exacerbations of chronic middle ear inflammation. It is an accompaniment of involvements of the tube in acute rhinitis and pharyngitis. Its presence in middle ear catarrh and sclerosis is taken by the writer as a sign of a continuing degeneration of the middle ear region, the cause of which should be sought for in the nose, pharynx or tonsils as well as in the tubes. It is a symptom frequently ignored by the patient, especially in chronic cases and must nearly always be inquired for, in order to determine its presence or absence. It is never present in normal tubes nor in abnormally patent tubes. It is not a prominent symptom in very markedly obstructed tubes and can not occur in absolute closure of the tubes. It appears to be common in pharyngitis with or without involvement of more than the pharyngeal mouths of the Eustachian tubes. It is hence a frequent precursor as well as an accompanying symptom of various diseases, though it has been observed to occur at intervals for a long time without the accompaniment of noticeable impairment of hearing. On the appearance of the latter symptom, the occurrence of snapping sounds in cases of gradually progressive ear disease may cease or may become less frequent, or the patient may be so used to it that it is rarely complained of.

This symptom of tubal obstruction (snapping) may continue or recur at intervals in all forms of non-suppurative middle ear diseases. Its irregular recurrence may indicate that these periods of obstruction of the tubes are partially or wholly responsible for the irregular course of the degenerative changes taking place in the ear.

Paracusis. A symptom often complained of in Eustachian obstruction, though I believe not pathognomonic, is a sense of fulness in the ears, with more or less impairment of

hearing (the latter may be absent) and a sound-sensation in speaking as if talking in a hollow space or into a barrel. Vertigo, usually slight, sometimes quite severe, may accompany this symptom. I am in the habit of associating these with a considerable degree of swelling of the tubal membrane. They disappear when due to tubal obstruction, on the disappearance of the acute symptoms of the latter. Recurrence may take place with each attack of acute inflammation in nose, pharynx and tubes.

Pain. Pain due to tubal inflammation is rarely present without inflammation of the tympanic cavity and I think can rarely be demonstrated as referable to the tube alone.

Pain in the Eustachian tube, however, is rarely located by patients. The discomfort of passing the Eustachian bougie is usually referred by the patient either to the ear or to the side of the throat. The objective symptoms may be slight or absent; though, if the obstruction is pronounced the retraction of the membrana tympani is very noticeable.

Itching. Two cases in which a sensation of itching seems clearly referable to tubal congestion are briefly reported.

1. Philip Kelly, twenty-five years old, has had impairment of hearing and tinitus for three months following a "cold." At first he had a great deal of snapping in his ears on swallowing or blowing the nose. Watch, Right 1-60. Left 1-120. An itching sensation felt in the throat. He has tried to relieve this by scraping it as far inside the back of the throat as he could reach with his finger nail. Extreme retraction of the drum membrane, slight congestion of vessels of drum.

2. Henry Molloy, twenty years of age, has had severe tinnitis for one week in both ears, following a salt-water bath. On the fourth day he had slight pain in the ear, but no disturbance of sleep. Previously there was snapping in the ears. At present he has a sensation of fullness in the ears. Tinnitus is noticeable in both ears and an itching apparently deep in the ears. The drum shows retraction and slight congestion of hammer vessels.

A sensation described as itching or "crawling" in the ears or tube is sometimes a symptom of tubal obstruction. Thus a lady of forty years (Everdell, July 31, '05,) who complained that she had at times a sensation in the ears as though there were something crawling in her ear, obtained relief for a time after each auto-inflation.

The tympanic cavity, however, does not maintain its integrity after the occurrence of pronounced obstruction of the tube and a reddening of the membrana tympani soon occurs.

Tinnitus. Diseases of the naso-pharynx and Eustachian tube are so admittedly causes of tinnitus that one accepts it axiomatically. That tinnitus is, frequently, directly referable to tubal congestion or inflammation, I think certain. It is a matter of observation that the inhaling of cigarette smoke may cause an immediate increase of tinnitus. An **initial** inhalation may cause this. As this may occur with the first inhalation and without swallowing or any act which would draw open the tube, it seems clear enough that the irritating effect of the smoke on the pharyngeal mouth of the tube is responsible for this. If irritation at the mouth of the tube may cause or increase tinnitus, it is proper to infer that irritation, congestion or inflammation of the deeper part of the tube may cause tinnitus. This is not a mooted point, but I have frequently found it difficult to refer tinnitus definitely to this region.

The symptom of a snapping sound heard by persons with moderate degree of obstruction of the tube on swallowing, blowing the nose, protruding the lower jaw and certain other methods of contracting the tensor and levator palati muscles, is of importance in indicating a continuing of the tubal trouble even after the existence of middle and internal ear disease of many years' standing. How much influence these continued or recurring obstructions of the tubes bear upon the progress of the trouble I am not prepared to say, but I believe it worth while to ascertain the presence or absence of this symptom, not only because its presence

indicates the need of treatment of the tube, but also in that it indicates a moderate degree of obstruction, rather tending to a favorable prognosis, other conditions being equal.

When snapping sounds are absent, I believe it indicates that there is no obstruction, as in some sclerotic or atrophic changes, or that the tube is so much obstructed that air is conducted to the tympanic cavity only with great difficulty. Further examination and tests easily reveal which of the two conditions is present.

The following table shows the considerable proportion of non-suppurative ear diseases in which the above symptom was found in a series of cases from a clinic in January.

Sex.	Age.	Disease and its duration.	Absence or presence of snapping sounds.	Remarks.
Male	69	o. m. c. c. 10 yrs.	Affirmative	Noticed at intervals only; more noticeable before treatment was begun.
Male	27	o. m. c. c. 5 yrs.	?	Mucus evacuated from tube on catheterizing.
Female	25	o. m. p. resid. 4 to 6 yrs.	Negative	Chronic pharyngitis present.
Female	65	o. m. c. c. 20 yrs.	Affirmative	Noticed on coughing as well on blowing the nose.
Female	—	o. m. c. c. 5 yrs.	Affirmative	Snapping also occurs without effort on part of patient.
Male	26	o. m. c. c.	Negative	
Female	50	o. m. c. c.	Negative	
Female	40	o. m. p. resid.	Affirmative	Vertigo at times.
Female	29	o. m. c. c.	Negative	
Female	19	o. m. c. c.	Negative	Snapping occurred previously i. e. before treatment was instituted.
Male	49	ot. med. et int.	Negative	
Female	6	Day after recovery from o. m. p. a.	Negative	No sound noted on Politzerization.
Male	59	ot. med. et int.	Affirmative	
Female	39	Recovered from mastoid op.	Affirmative	

Sex.	Age.	Disease and its duration.	Absence or presence of snapping sounds.	Remarks.
Male	40	Tubal catarrh	Affirmative	States snapping is almost continuous. Is a cigar maker.
Female	20	o. m. scl. 5 yrs.	Affirmative	At times not noticeable.
Male	43	o. m. c. c.	Affirmative	
Male	52	ot. med. et int.	?	Formerly much snapping. At present none; but hearing is worse than when snapping occurred.

The evidence of the presence of tubal obstruction in chronic middle ear diseases indicates a need for the treatment of this important complication. It may be possible to do little or nothing for the middle ear diseases other than that affecting the tube alone, which as a rule is tractable. Treatment directed to the relief of tubal obstruction alone, has a positive effect in preventing or checking the progress of diseases affecting other portions of the sound conducting apparatus.

PARTIAL BIBLIOGRAPHY OF RECENT PAPERS RELATING TO THE EUSTACHIAN TUBE.

By WILLIAM C. BRAISLIN, M. D., Brooklyn, N. Y.

In the preparation of this list the reports on the progress of otology in the **Archives of Otology** have been freely utilized. This has enabled the writer to include several important papers in the list, the originals of which would not have been readily accessible, though in nearly all instances the references have been verified by direct examination of the papers themselves. In most cases of articles not written in English the titles are given in translation.

Allen, Harrison, On a New Method of Recording the Motions of the Soft Palate, Trans. of the Coll. of Physicians of Philadelphia, 3rd Series, Vol. VII., 1884, pp. 164-194. Allen observes that motions of the soft palate are transmitted to a rod passed along the floor of the nose into the pharynx, and, by means of a mechanism, these motions are recorded on a revolving cylinder in much the same way that the heart impulses are similarly recorded. It furnishes a positive basis of record of the motions of the soft palate. Tracings of various consonant and vowel sounds are figured and the method. Allen suggests its usefulness in paralysis of the palate, also possibly in stammering and in determining the degree of degeneration of the levator palate muscles in progressive dry catarrh.

Bacon, Gorham, The Anatomy, Physiology and Diseases of the Eustachian Tube. Reference Hand-book of the Medical Sciences, Vol. II., N. Y., 1886.

Ballenger, Wm. L., Tenotomy of the Tensor Tympani Muscle for the Relief of Deafness and Tinnitus. Laryngoscope VIII., 1900, pp. 85-89. The causes, indications for operative interference and contraindications for same are described.

Baratous, J., De electrolyse de la Galvanocaustique clinnique de la trompe d' Eustache. Revue Mens. de Laryng. 1884, No. 6, pp. 185-194 (on electrolysis or chemical galvanic cautery treatment of the Eustachian tube). B. refers to previous

attempts at the employment of electrolysis for obstructions of the tubes. He used a hard rubber catheter, at its enlarged end a hole, through which an electrode of silver or platinum is introduced. The second electrode is placed on the mastoid process. The current is used not stronger than five milliamperemeters nor longer than five minutes.

Bernond, The Treatment of Deafness with Insufflations of Hot Air. Wiener Med. Blätter, XXVI., No. 39, 1904, pp. 475-477. The apparatus of Beck is used. The temperature of the air is regulated by an electrical heater. B. states that tinnitus disappears and a slight improvement in the hearing occurs from its use.

Bezold, Friedrich, A Case of Perforating Wound of the Organs of Hearing, in Court, and Subsequent Indictment of the Plaintiff for Supposed Simalation and Perjury, Berliner Klin. Wochenschrift, XX., No. 40, 1883, pp. 611-614. An individual received a shot wound of the left ear and brought suit against his assailant. This case was finally referred to B. for an expert opinion. He found that the injury (a cut inflicted by the defendant with a sharp-pointed knife in the neck) had penetrated the lumen of the tube causing a complete obstruction. A whalebone bougie met the obstruction 14 mm. within the mouth of the tube.

Bezold, F., Cholesteatoma, Perforation of Shrapnell's Membrane, and Occlusion of the Tube. An Aetiological Study. Translation by Dr. J. A. Spalding, Archives of Otology, XIX., 1890, pp. 232-254. A case was observed, post-mortem, of entire occlusion of the tympanic orifice, demonstrated viz., a marginal adhesion of the entire periphery of a perforation of Mt. existed. When the tube was inflated the rest of the Mt. puffed out all about the tubal orifice.

Blake, Clarence J., reviewing article by C. Nicoladoni, Beobachtung am Lebenden über die Bewegung der Tuba Eustachii, Arch. Ophthalmology and Otology, Vol. V., 1876, p. 122, states that he saw a case in which the normal Mt. was lacking and a thin cicatrix extended over the auditory canal. At the commencement of the act of swallowing this cicatrix was forcibly extended, falling into place at the end of the act.

Blau, L., Ein fall von kronischen Krampf des musculus Tensor Tympani ohni subjective Empfindnng. Archiv. für Oherenheilkunde, Bd., XIII., p. 261. A 14 year old boy had sensation of pressure and temporary lancinating pains in his right

ear, increased resonance of his own voice, many subjective auditory perceptions, normal hearing. Spasmodic rapid motions of the Mt. were observable; also changes in the cone of light or extreme retractions of the Mt. not connected with respiration. Author attributes these to contractions of tensor tympani muscle.

Bonnier, M. P., The Tubo-tympanic Functions. Note, presented by Girard. Compt. rend, des Séances de la Soc. de Biol., Nov. 26, 1892, Feb. 18, 1893, April 15, 1893. "Descriptions of the manner in which the Eustachian tube, the tympanum, otoliths and otocysts assist in the functions of the apparatus of equilibrium."

Boulai, Voluntary Contraction of the Muscles of the Tympanic Membrane. Arch. internat. de Laryngol, etc., XIII., 2, 1893. Two cases observed where a distinctly audible crackling noise occurred, 30 times a minute. In one, the drum showed simultaneous vibrations. It could be produced voluntarily. B. considered it due to contractions of the tensor tympani.

Braislin, Wm. C., Eustachian Catarrh with Hyperinflation. Report of a case. Archives of Otology, XXXVII., 1908, pp. 215-216. Report of a case of extreme patency of the Eustachian tube, with an account of symptoms.

Brandegee, Wm. P., Tympanic Vertigo due to Obstruction within the Eustachian Tube. Arch. of Otology, XXX., 1901, pp. 205-213. The value of the electrolytic bougie is contended for. Over other forms of bougies B. claims the advantages of ease of manipulation, a minimum of pain, a minimum amount of trauma, thorough destruction of the stricture or occlusion and that the force to be used should be only that sufficient to insure good contact for the current.

Broich, F., Method of Direct Vibratory Massage of the Eustachian Tube and Its Effects on the Middle Ear. Report Germ. Otol. Soc. Arch. of Otol., XXVIII., 1899, pp. 388-389. Special probes introduced by way of the nose afford a direct massage of the pharyngeal ostium and the commencement of the tubal canal, as produced by Spoes' saw-handle driven by the electro-magnet.

Brunner, Gustav, On Alterations in the Hearing by One's Own Voice. Arch. Ophthal. and Otol., II. No. 1, 1870, pp. 107-126. Case of deafness (obstr. of tube) in which patient's own voice seems too loud in affected ear and very disagreeable. Inflation of air through tube caused cessation of symptoms. Regarded symptoms as not due to exudation of fluid in middle ear.

Brunner, G., On Vertigo Occurring in Affections of the Ear (Auditory Vertigo). Archives of Ophthalmology and Otology, II. No. 1, 1870, pp. 293-341. Vertigo may be occasioned by external pressure upon the drum-heads, by impulsions of air or liquids into the tympanic cavity through the Eustachian tubes or by the passage of a galvanic current through the ears. In injecting sulphate of zinc, one and one-half grains to the ounce, in right ear, his patient felt as if drawn to the direction of same side (right). [He says erroneously that the patient had a tendency to fall towards the right side. The patient makes an effort to overcome the apparent (to the patient) falling to the right and falls to the left side in such a case].

Bryant, W. Sohier, Demonstration of the Movements of the Eustachian Tube. Archives of Otology, XXXV., 1906, p. 564. (No details reported).

Bryant, W. Sohier, The Anatomy of the Child's Ear, Emphasizing Points of Practical Importance. Arch. of Otol., XXXIV., 1905, pp. 80-83. Bony portion of Eustachian tube absent at birth. Cribriform bone interposed between the floor of the tympanum and the carotid canal at the jugular fossa, which is below the tympanum, not behind. The mastoid is but slightly developed. The Eustachian tube is narrower and much shorter in the infant. It measures about 20 m. as against about 40 m. in the adult from the anterior border of the sulcus tympanicus. Its lumen at the isthmus is 2 m. as against 4 m. in the adult. It lies in a horizontal plane. Its angle with the median plane is about 45° and outwards as in the adult. At puberty it assumes the adult position. The relative position of the pharyngeal mouth of the Eust. tube to the posterior pharyngeal wall and the velum palati is farther forward and slightly lower down. The fossa of Rosenmüller does not form a deep depression till later in life. At birth the cavity of the middle ear, being filled with myxomatous tissue and detritus no air enters the tube immediately [but it is probable that the motion of the tensors produced by sucking, rapidly stimulates the opening of the tube].

Bryant, W. Sohier, The Eustachian Tube, Its Anatomy and Its Movements; With a Description of the Cartilages, Muscles, Fasciae, and the Fossa of Rosenmüller. Medical Record, LXXI., pp. 931-934, 1907. A detailed anatomical study of this region.

Buck, A. H., Unnatural Patency of the Eustachian Tube. Am. Jour. of Otology, II., 1880, pp. 203-205. A case related.

Bürkner, Report on the Treatment of Affections of the Tube. Report German Otol. Soc., 3rd meeting. Arch. of Otology, XXIV., 1895, pp. 59-62. Attention is called to the importance of catheterization when there is swelling in and mucous secretion of the tube, preferring it to Politzerization. The fear of causing infection of the middle ear in acute naso-pharyngeal or tubal affections is an exaggerated one, the neglect to inflate the middle ear causing the most harm. Gargling is regarded as an important measure in all simple tubal affections. Injections through the catheter are useful but should not be irritating. The use of the bougie in the tube is only indicated when catheterization causes no improvement. Medications and the use of the bougie are seldom productive of good results, though the vibration massage, by means of the bougie, by Urbantschitsch's method, is sometimes indicated. This is often painful. Politzer's method of external massage, on the other hand, is not. In atresia of the tube electrolysis and excision of the drum membrane and malleus are measures for consideration. Abnormal patulousness of the tube and abnormal conditions of the nose and naso-pharynx (ulcerative processes, synechiae, adenoid vegetations and hypertrophy of the tube) are important in their bearing. Galvano-cautery is not devoid of danger; acids are preferable. Discussion: Bezold agrees that the air douche should be used in acute affections of the tube: Catheterization is often preferable to Politzerization even in children. He has never found atresia of the tube in all his autopsies. The use of the bougie should be restricted. Bresgen recommends removal of nasal obstructions. Siebenmann does not consider nasal obstruction to have any etiologic significance in tubal disease. Apart from adenoids he has not found stenosis at autopsies. Barth and Fischenick believe nasal obstruction an etiological factor. Hartmann uses inflation as long as good results are obtained. He frequently uses injections. Cocaine acts well. Removal of nasal tumor may often be dispensed with if thin, short-beaked catheters are used.

Calhoun, A. W., Adenoid Vegetations, with Especial Reference to Their Influence Upon the Ear. Laryngoscope, VI., 1899, pp. 164-168. "Direct pressure upon the mouth of the tube rarely occurs, and yet its function is so frequently inter-

fered with that contraction or sinking of the drum-head follows. Perhaps the aural symptoms are due to the swelling of the mouth of the tube or an extension of the inflammatory process through the tube into the middle ear. Breathing through the mouth and the blocking of the post-nasal space change the air currents and alter the pressure about the mouth of the tube." The growth hinders the free action of the muscles controlling the lumen of the tube and permitting the entrance of air into the middle ear. This condition causes defects of hearing. This process sooner or later ends in chronic catarrhal otitis media with ankylosis of the ossicles. A suppurative inflammation frequently results from the presence of the mass.

Camerer, Foreign Body in the Eustachian Tube. Archiv. für Ohrenheilk, XL., 1896, pp. 63-64; Tubingen, 1894, Abs. A six-year-old boy fell from a wagon fifteen months previously. A piece of straw was driven into the mouth at that time but the visible portion was removed. One month later the right lateral pharyngeal region presented a swollen condition and otorrhea appeared in right ear. The latter continued a year with latterly aural hemorrhage. On the removal of offensive pus and granulations, roughened bone was detected and a movable body, which when removed proved to be a straw, 4½ cm. by 2 mm.

Citelli, S., On the Structure of the Human Eustachian Tube. Archivio italiano di otologia, XVI., 1905, pp. 404-418, pp. 441-452. The histology of the tube is given in detail.

Collet, On Salpingoscopy. Lyon Médical, 46, 1903, pp. 725-730. The Valentin Salpingoscope is recommended.

Dench, E. B., New Eustachian Bougie. Archives of Otology, XXI., 1892, pp. 149-156. A fine whalebone bougie is used. This is attached to the catheter by guides so that the lumen of the tube is not obstructed; at the same time the bougie may be passed into the tube at the same introduction as the catheter.

Denker, The Eustachian Tube of the Ant-Eater. Zeitschr. für Morphologie u. Antropologie, Bd. VIII., pp. 1-10. A paper regarding the comparative anatomy of Myrmecophaga jubata and M. didactyla.

Denker, Investigations of the Eustachian Tube of the Ant-Eater. Myrmecophaga, didactyla st M. jubata. Trans. Ger. Otol. Soc., 1904. In the first, no true tube exists, for a broad cavity surrounded by membranous walls occupies the place

of the tube. No bony tube. There is a round opening from the posterior and inferior corner of the tympanum to which the membranous canal is attached. In the latter species the large cavity is surrounded anteriorily by the tympanum and the pterygoid, posteriorily by a process of the basilar occipital.

Dennert, H., Zur Physiologie der Tuba Eustachii Grund einer Beobachtung von doppeleitigen organischen Verschluss der Raschenmendung derselben. Deutsche Zeitschrift für Pract. Medicin, No. 44, 1878. D. observed a patient with great syphilitic destruction of the naso-pharyngeal space. Cicatrix closed off the mouths of the Eustachian tube. Hearing was impaired and tinnitus present. During the act of swallowing both (most in left) Mt. were observed to sink in with subsequent outward motion. The same was observed when the nose was held during deglutition. D. thinks the phenomena due to a dilitation of the tube in the act of swallowing, producing a rarefication of the enclosed air.

De Rossi, Researches on the Micro-organisms in the Eustachian Tube of Healthy Individuals. Trans. 9th Internat. Med. Cong., pp. 859-862, 1887, Washington. In the secretions of the Eustachian tubes of twelve healthy individuals examined, the presence of germs was determined in six. None were of a pathologic character.

De Simoni, A., Intratympanic Injections in the Treatment of Chronic Middle Ear Catarrh. Arch. ital. di otologia, VII., p. 81. States good results followed use of vaseline oil and iodoform-ether through Eustachian tubes.

Duel, Arthur B., The Possibilities and Limitations of the Electroyltic Bougie in the Treatment of Chronic Catarrhal Otitis. Laryngoscope, XIII., 1903, pp. 523-532. D. thinks this method pre-eminent as a method of restoring patency of the tube. Best results are obtained by employing it sparingly and in connection with other forms of treatment. Intervals of two weeks should elapse before repetition. Caution is advised against using too often, too strong, and too hurriedly. Small bougies, small current, time and patience are advised.

Duel, A. B., The Rapid Dilation of the Eustachian Tube by Electrolysis. Laryngoscope, III., 1897, pp. 31-37. The electrolytic action of the negative pole of the galvanic current is employed. It is applied by one of four copper bougies, Nos. 3 to 6 French, mounted on No. 5 piano wire. They are passed through insulated silver catheters.

Duel, A. B., An Additional Note on the Treatment of Strictures of the Eustachian Tube by Electrolysis. Laryngoscope. IV., 1898, pp. 116-119. D. repeats that this treatment is not recommended for sclerosis but only for narrowing of the tube. 20 to 40 volts are required of 2 to 5 amperes. The operator should satisfy himself that the catheter is in place by the rhinoscopic mirror, or by successful inflation before the introduction of the gold bougie. The silver catheter is insulated by rubber dressing. The bougie should be pushed past the constriction slowly, occupying two minutes or more. The bougieing should not be repeated before a week or more but inflations should be continued. Many cases seem to be cured by one bougieing.

Duel, A. B., The Value of Electrolytic Dilitation of the Eustachian Tubes in Chronic Tubal Catarrh and Chronic Otitis Media. Amer. Jour. Med. Sciences, April, 1900. Many of the 50 reported cases were relieved or much improved as to the vertigo and tinnitus by restoration of the patency of the tubes. In nearly one-half the impairment of hearing was improved. The bougies are made of solid gold 2, 3 and 4 French scale. They should fit the tube snugly. The bougie is attached to the negative pole; the positive pole held in the patient's hand. Obstructions in the tube are overcome by using from 1 to 3 amperes of the current. After 20 seconds the bougie may be further introduced. It is not employed for more than five minutes at one time, and repeated at intervals of one week to one month, inflations being practised every other day. Two to four sittings are usually sufficient. A battery of 30 to 50 volts is employed.

Eitelberg, von A., Bougieing the Eustachian Tube. Tr. by Dr. Cornelius Williams. Archives of Otology, XIII., 1884, pp. 168-182. E. ascertained the average length of the Eustachian tube in adults as 36 to 44 mm. In the newly born the average is 19 mm. E. found that the penetration of the catheter amounted to from 6 to 11 mm. The longest tube measured among 15 fresh specimens was 48 mm.; the isthmus tubæ in this case was 28 mm. from the tubal orifice (pharyngeal end). The average distance from the ostium pharyngeum to the isthmus is 24 mm. The normal width of the isthmus is 1½ to 2 mm. In a case of chronic suppuration a bougie of large size (No. 4 Charrière) freely entered both tubes and could be made to

present in the auditory canals. The average length of the Eustachian tube as measured on the living patients was about 35 mm. Stricture of the middle part of the tube is exceedingly rare. In three cases E. succeeded in passing a bougie of larger size further into the tube than the smaller bougie would penetrate. He thinks this is due to the smaller tube being more readily engaged by folds of mucous membrane; also rotation on its long axis of a larger bougie more readily releases it. The infantile tube is both relatively and absolutely wider than the adult at its narrowest part, according to this author.

Eschweiler, On the Development of the Sound-Conducting Apparatus, with a Special Regard to the Tensor Tympani Muscle. Arch. für micr. Anat. XLIII., pp. 150-196.

Fischenick, Fr., The Treatment of Catarrhal Adhesive Processes in the Middle Ear with Intratubal Pilocarpine Injections. Berlin Klin. Wochenschr., Vol. 37, 1900; pp. 1033-1034. F. regards intratubal injections useful in sclerosis. Six to sixteen drops of a two per cent. solution are injected into each tube. Thirty to sixty sittings are given.

Ferguson, H. Lindo, An Improved Form of Eustachian Catheter. Archives of Otology, XIII., 1884, p. 296. A flexible tube bent to the proper curve is used. Into this is passed a straight stylet. It is used where obstructions forbidding the use of the ordinary catheter are met with. On passing the obstructions the style is withdrawn, whereupon the catheter assumes its proper shape.

Fournié, Edw., Du Role physiologique de la Trompe d'Eustache. Congrès periodique internat. d'otologie, 2d. mi., lan. 1880, pp. 119-126.

Goldstein, M. D., The Use and Abuse of the Eustachian Bougie. Laryngoscope, XIII., 1903, pp. 515-522. G. regards them of value in all chronic middle ear affections. Counter-indicated when patient complains of "fulness" after use or when hearing is dulled by them.

Gomperz, Typical Alterations of the Tension of the Membrana Tympani in Valvular Occlusions of the Eustachian Tubes. Rept. 1st meeting, Austrian Otol. Congress. Wiener Klin. Woch., IX., 1896, pp. 843-846. Bulgings of the postero-superior portion of the Mt. occur in otherwise normal Mt. and T. cavity. Symptoms occur-

ring are sensations of pressure, tension, slight subjective noises and occasional deafness. With use of Siegle's etoscope the postero-sup. quadrant follows its compressions or rarefactions but immediately jerks into its former bulged position. The most precautious blowing of the nose produces a feeling of air striking the Mt.. Therefore no impediment to the entrance of air exists, but one to its exit. In G.'s cases catarrh of the naso-pharynx, hypertrophy of the mucous membrane, polypi or suppuration of the accessory cavities were found.

Gradenigo, G., Diagnosis, Prognosis and Treatment of Progressive Deafness in Chronic Non-Suppurative Inflammation of the Middle Ear. Trans. by J. A. Spalding, Arch. Otol. XX., 1891, pp. 221-227. The contents of the tube were examined to ascertain the presence or absence of bacterial life in this disorder. The examination was negative, the only species of bacteria found were a few individuals of the bacteria of putrefaction commonly found in the air. (The same observations, elaborated, occur Centralbl f. Bacteriol, und Parasitenkunde, VIII., 1890, p. 225.

Gradle, H., On Headache from Overlooked Causes in the Naso-Pharynx and Ears. Jour. Am. Med. Assn., Vol. XI., Sept. 8, 1888, pp. 339-340. G. considers a certain type of continual headache, more commonly met in children, due to impaired patency of the Eustachian tubes.

Gruber, J., On the Therapeutic Value of Injections of Medicated Solutions into the Eustachian Tube. Monatschirft für Ohrenheil, XIV, 1880, pp. 133-139. Solutions injected into the Eustachian tube soften, but do not dissolve mucus, so that it can then be more readily removed by catheter. They also benefit, by producing a new inflammation, in certain conditions. Gruber believes that injections detach synechiae extending from drum to tympanic walls or to ossicles even when air douche has not benefited.

Haike, H., Tuberculosis Ear Disease in Nurslings. Deutsche Med. Wochenschr. [Vol. 31] 1905, pp. 954-957. In five fatal cases the duration of the lesion was several weeks or months. In two cases, the possibility of the infective sputum entering through the Eustachian tubes could not be excluded. In the others the ear lesion was primary. The port of entry was the mouth or pharynx. Moreover, the author states, the tube may itself be the seat of disease in nurslings, while in adults it is merely the path of tubercular sputum.

Hammerschlag, V., Respiratory and Pulsatory Movements of the Drum Membrane. 1st Austrian Otol. Cong. Report, in Arch. of Otol., XXV., 1895, pp. 408-409. The investigations were made with an instrument similar to that of Mach, upon 4 healthy young individuals, in 30 observations. He found the Mt. exhibits constant movements, coincident with the systole of the heart.

Hammerschlag, V., On the Function of the Eustachian Tube. Arch. für Ohrenheilk, XLIII., 1897, p. 65, (a reply to Lucae's article in Arch. f. O.). He believes the middle ear and naso-pharynx are in open communication. [Hartman, in Arch. of Otol., XXVII., 1898, pp. 179-180 again shows the fallacy of this belief in a review of the article. During inspiration alone no equalization of pressure ordinarily occurs, but on deglutition equalization is restored. B.].

Hammerschlag, V., On the Reflex Movements of the Tensor Tympani and Its Central Paths. Sitzungber der Wien Akad, Math-naturn, Bd. CVIII., 3, p. 1. The contraction of the tensor in dogs, is believed by H. to be a reflex, passing through the auditory nerve and originating in sound waves. In addition to the tract between the eighth and the fifth nuclei of the same side there is one between the eighth nerve nucleus of the one and the fifth motor nucleus of the other. Contractions of the tensor tympani occur after removal of the entire brain cortex, hence is a pure reflex process.

Hartmann, A., Function der Tuba Eustachii. Archiv. f. Anat. und Physiologie, 1874. Experiments regarding the amount of pressure necessary to inject air through the tubes under varying conditions. While the muscles were in a state of rest air entered at a pressure of 20 to 40 mm. column of mercury. During the act of swallowing, 20 mm. or less was sufficient. In only one of the individuals who submitted himself to the experiments, the Eustachian tubes were open in a state of rest and the membrana tympani were pressed outward at a pressure of 10 mm. of mercury.

Hartmann, A., Mittheilung über die Function der Tuba Eustachii. Archiv. für Anatomie und Physiologie, 1877, pp. 543-548. H. concludes that the act of swallowing draws tense the membranous walls of the tube, transforming this previously flaccid canal into a rigid one, that the tube remains closed as long as the muscles of the soft palate are at rest. He states that the weight of 200 mm. of mercury by manometric measurement is incapable of causing air to enter the tube

while the muscles are uncontracted; and he believes that the membranous wall is but pressed the more firmly against the cartilaginous anterior wall of the tube; but that this valvular action is overcome by swallowing. From within the middle ear, air readily escapes from the pharyngeal orifice of the tube, as is proved by the escape of air bubbles when a person in the pneumatic cabinet is subjected to only slight rarefication of atmospheric pressure.

Hartmann, A., Experimentelle Studien ueber die Function der Eustachisen Röhre. Leipsic, 1879. H. states that great condensation of the air in the naso-pharynx opposes the opening of the tube, even during deglutition, by reason of the air pressure acting to force the membranous part of the tube against the cartilaginous roof. He proves that during respiration no interchange of air occurs between the tympanic cavity and pharynx in normal tubes. If abnormally patent there is an interchange, noticeable in a visible vibration of the Mt. coincident with respiration. Phonation may facilitate the passage of air but does not do it so completely as deglutition. He accepts Zaufals' view that the act of deglutition moves the medial cartilaginous plate of the tube backward and medially. Thus the floor of the mouth of the tube expands by the separation of the lateral walls from each other. Simultaneously the prominence of the levator advances toward the orifice of the tube which is thereby narrowed from above, downward, and from behind, forward. The sound-conducting power of the tube is but slightly discussed.

Hartmann, A., Uber die Bestimmung der Durchgängigkeit der Eustachischen Röhre mit Hülfe des Quicksilbermanometers, Virchow's Archives, Bd. LXXIV., 1878, pp. 420-424. A repetition of the views expressed in his monograph on same subject.

Haug, R., Foreign Body in the Tubal Region After a Previous Radical Operation: Tonsillar Abscess. Arch, f. Ohrenh., LVII., p. 45. A cotton pledget was lost in the depths of the auditory canal during the performance of a radical mastoid operation. An abscess of the peritonsillar tissue later appeared and on its evacuation the cotton pledget appeared. It was supposed to have reached its location through the levator muscle.

Heflebower, R. C., Clonic Spasm of the Tensor Tympani, N. Y. Med. Jour., LXI., 1895, pp. 325-328. A clicking noise ac-

companied by twitching of throat muscles was complained of. A perceptible indrawing of the central and lower part of Mt. was visible at time of each click.

Holinger, J., Spongyfying of the Labyrinth. Laryngoscope, XI., 1901, pp. 31-35. An attempt is made by H. to differentiate between the diseases named and Eustachian obstruction. In Eustachian obstruction he gives predominant symptoms as: (a.) Retraction of the Mt., often extreme. (b.) Nose is affected by hypertrophies and subject to frequent colds. Pharynx is always examined with mirror and palate hook. (c.) Hearing distance increases after catheterization. Smokers' catarrh and stomach disorders affect the disease. In spongification of the labyrinth we have: (a.) usually a history of deafness in family. (b.) The onset rarely begins before the age of 18 to 24. (c.) Sudden increase of deafness with heavy cannon shot noises. (d.) Mt. normal or nearly so. Nose, normal as a rule. Finally in the latter we have negative Rinné test, increased bone conduction for the lower sounds and a defect in hearing ability, mostly at the lower limits of the normal range.

Hopkins, Agnes, On the Relative Dimensions of the Osseous Semicircular Canals of Birds. Biological Bulletin, Vol. XI., 1906, pp. 253-263. "The Eustachian tubes of birds have a common oesophageal opening in all cases, except in the genera Struthio, Eudytes, and Tinamus where there is a pair of apertures. The Eustachian tube is a perfect bony tube in the following: Sterna, Squatarola, Ceryle, Psittacus, Geococcyx, Tetraonidae, Phasianidae, Catharista, Falco, Endytes and Tinamus. In all other cases it is imperfectly ossified."

Hopkins, Frank T., Electrolysis in the Treatment of Chronic Eustachian Stenosis. Archives of Otology, XXXIV., 1905, pp. 495-501. H. begins with a No. 1 bougie (French) and at intervals of from two to four weeks, repeated until at the expiration of several months the next size may be easily introduced. In the same way proceed to the use of Nos. 3 and 4 or even 5. Between the times of using the bougies, inflation with vapor or air is used. In the discussion (ibid. pp. 539-546) members gave varying opinions regarding the usefulness of the electric bougie. Some had found the bone bougie equally good or better than the electrolysis. Several cases in which the tip of the gold bougie had broken off in the tube, where they still remained, without the patient being apparently worse than before, were reported.

Hovell, T. Mark, Catheterization of the Eustachian Tube. Brit. Med. Jour., Oct. 22, 1898, p. 1238. The author here proposes (1) that the gauge of the Eustachian catheter be that of the French catheter gauge; (2) that the length of the curve of the instrument be expressed in millimeters, the number indicating the distance the curve separates two parallel lines.

Hovell, T. Mark, Catheterization of the Eustachian Tubes. Archives of Otol. XXVIII., 1899, pp. 51-52. The need of a uniformity of scale in the measurements of Eustachian catheter is stated.

Hubbard, Thomas, An Apparatus of Precision for Inflating and Medicating the Tympanum. Archives of Otol., XXII., 1893, pp. 27-32. An instrument is described by which sterile air is used for politzeration or inflation of the Eustachian tubes.

Jacobi, A., Otitis Media in Children. Arch. of Otol., XXXIV., 1905, pp. 90-101. Pyogenic microbes enter the middle ear chiefly by way of the Eustachian tube which R. O. Newman finds, even normally, contains microbes. They enter especially when coughing, sneezing or vomiting. Mainly so when the nares are obstructed by swelling, by a membrane or by congenital occlusion. The vibrating epithelia of the tube become paralyzed in conditions of ill-nutrition, colds and atrophy. In the young, the Eustachian tube is shorter but wider both at the isthmus and at the tympanic orifice and the direction of the canal is almost horizontal.

Joachim, Otto, Contribution to the Physiology of the Soft Palate Archives of Otology, XVIII., 1889, pp. 226-234. The entire nose was destroyed by syphilis in a case of the writer's, giving easy view of the entire pharynx and mouths of the Eustachian tubes. The orifice of the left tube was impervious and occluded with a considerably reduced power of hearing on this side. The effect of various articulated sounds on the motions of the soft palate and Eustachian orifice was carefully studied by the author.

Kayser, R., Contribution to the Pathology and Treatment of Objective Ear Noises which, according to their Mode of Development, are divided into Tubal and Real Ear Noises. Trans. German Otol. Soc., 4th meeting, 1895. Arch. of Otol., XXIV., 1895, pp. 328-329. "The tubal noises are either

muscular or elsewhere developed, as in autophonia, but transferred by changes to the tube. He considers the first form allied to chorea and hysteria, caused by contraction of the tensor veli palati. He uses for treatment an irritation by pressing either the velum palati, mastoid process or the teeth, but with varying success. If the snapping noise is produced by the separation of the tubal walls, a probe is introduced with immediate good results which persisted in but three cases." A discussion on the possibility of hearing the noises produced by the contraction of the tensor tympani arose but the views were discordant.

Kenefick, Joseph H., Electrolysis in the Destruction of Organized Strictures of the Eustachian Tube. Archives of Otology, XXX., 1901, pp. 73-84. K. concludes: (1) That it cannot be foretold in any given case just what result will follow this treatment, as this will depend largely on two comparatively unknown quantities, viz., (a.) the vasculartiy of the tube lining and its toleration of the electrical interference, and (b.) on the degree of tympanic involvement. (2) That tubal obstruction is present early in the great majority of cases of so-called chronic hypertrophic catarrhal otitis media and that their mechanical obstructions may be removed at an early stage of middle ear involvement with excellent results. (3) That the best means of reabsorption of an organized obstruction of the Eustachian tube is by the electrolytic bougie.

Kerrison, Philip D., Tinnitus Aurium. K. classifies the various sources of tinnitus as due to: (1) Conduction sounds. (2) Blood sounds. (3) Labyrinthine sounds—alteration of intralabyrinthine pressures. (4) Neurotic sounds—increased irritability of the nerve. (5) Cerebral sounds—lesions of the cerebral cortex.

Kirchner, W., On Formation of Diverticles in the Eustachian Tube, in Man. Pt. I. from "Festschrift für A. Koelliker, Leipsic, 1887. A specimen of an Eustachian tube was shown, presenting a diverticle, lined with thin, firm membrane. It was situated about 1.5 mm. from the pharyngeal opening, about the size and form of a small bean 7 mm. in diameter and 6 mm. deep and opening by a sinus into the E. tube. The tube itself was unchanged in length or diameter and the lining mucous membrane presented no considerable change. The author is unable to conclude whether the malformation was congenital or the result of morbid action.

Koenig, On Passing Bougies in the Tubes. Trans. Seventh Int. Otol. Congress in Arch. of Otol., XXXIV., 1905, p. 348. Uses a combination catheter and bougie, the latter introduced into a small channel which opens into the calibre of the catheter. With a simultaneous application of the air-douche, performed by the patient with a double bag, the introduction of the bougie is performed more easily. A different catheter is used for each side.

Kostanecki, Casimir von, The Pharyngeal Ostium of the Eustachian Tube and its Relation to the Naso-pharyngeal cavity. Arch. f. Mikrosc. Anat., XXIX., 1887, pp. 539-592, pll. II. Some abnormal cases are related. K. observes that the pharyngeal tonsil may extend to the tuberosity of the Eustachian tube and even into its ostium.

Kyle, D. Braden, The Position of the Orifice of the Eustachian Tube and the Possibility of Catheterizing it through the Mouth. Phil. Med. Journal, II., Sept. 24, 1898, pp. 622-626. A catheter for use through the mouth is made of coin silver, six inches in length and flexible. The patient depresses the tongue with a tongue depressor while the operator locates the tube with a mirror and introduces the catheter.

Kyle, J. J., Natural Gas and Eustachian Inflammation. Jour. A. M. A., XXX., 1898, pp. 658-659. Natural gas, containing a large proportion of sulphuretted hydrogen, is regarded as most irritating to the nasal and tubal membrane.

Lake, Richard, Abnormal Course of the Chorda Tympani Through the Tympanic Cavity. Lancet, Jan. 5, 1895, p. 28. Exit at usual level, ran horizontally forward to lowest ¼ of malleus handle, thence upwards passing through canal of Huguier and keeping below the tensor tympani.

Lancereau, Infection of Syphilis by Means of the Eustachian Catheter. Union Med., XLI., 1886, pp. 469-474.

Laryngoscope, The, Is the Eustachian tube open or closed during the Act of Deglutition? Laryngoscope, closed! Editorial Laryngoscope, III., 1897, p. 190-191—a comment on Dr. Stillson's paper.

Laval, Nasal Ausculsation of the Ear During Catheterization. Archiv. für Ohrenh., LXVI., 1901, p. 120. By means of a hearing tube introduced high up in the opposite nostril, during catheterization, differential diagnosis is aimed at between the sounds heard at (a.) the tubal ostrium, (b.) the tube,

and (c.) the tympanum. The latter are not heard by nasal auscultation but only by aural. The sound of removing secretions from the tympanum through the tube is heard by nasal auscultation. Noises in E. tube are heard equally by nasal and aural auscultation. The greatest amount of crepitant râle is produced by the escape of the exudate. The blowing noise is produced in the cartilaginous tube. Its character depends on the form of the tubal secretion. Rough blowing murmurs are produced by swelling and moisture in the mucous membrane of the tube.

Lermoyez, M., and Helme, F., The Staphylococci of Otorrhoea. Annales des Mal. de l' oreille du nez et du phar., XXI., 1895, pp. 35-58. A discussion as to the appearances of micro-organisms in ear diseases preceding or following acute inflammations in ear.

Linhart, C. P., Rapid Dilatation of the Eustachian Tube. Columbus Med. Jour., XXV., 1901, pp. 345-351. Electrolysis is the method employed and recommended.

Lockard, L. B., The Eustachian Bougie. N. Y. Med. Jour., Dec. 29, 1900, pp. 1127-1129. Reviews the indications for, and the advantages and disadvantages of, the instrument. It is recommended in two conditions only: stenosis and tinnitus.

Lucae, August, Zum Mechanismus des Gaumensegels und der Tuba Eustachii bei Normalhörenden. Archiv. für Path. Anat., Bd. LXXIV., 1878, pp. 238-245. L. states that the mouth of the tube is compressed when the soft palate rises and is opened when it falls; hence, that a sort of pumping action of the tube is effected. He also believes it probable that an internal dilatation of the tube accompanies the external closure of the tube.

Marshall, Geo. M., What Can Be Accomplished by Treatment of the Eustachian Tube. Jour. A. M. A., XXX., Mar. 19, 1898, p. 656. Bougies, smeared with nitrate of silver, 15 grains to an ounce of lanolin, are recommended for chronic stenosis of E. tubes. They are left in place 20 to 30 minutes, not more than twice a week. Seven cases were greatly improved, five moderately, five no change.

Matlack, E., Electrolysis in Eustachian Salpingitis with Stricture. Report of seventy-five cases. American Medicine, Vol. 5, Feb. 7, 1903, pp. 223-224. Electrolysis is regarded as of service in all forms of deafness (excluding pure labyrinthine

conditions) and especially as in cases of moderate degree where the greatest changes are located in the tube. More improvement resulted than by any other treatment, how permanently is not yet known.

McKernon, James, Distressing Tinnitus Relieved by Bougieing the Eustachian Tube. Arch. of Otol., XXIX., 1900, pp. 394-395. The negative pole of a galvanic current was used in connection with a gold bougie, passed well into the tympanum. The current was 30 volts, 3½ milliamperes; contact, 2½ minutes. The tube was not strictured. Recovery was immediate and lasting.

Melzi, Urban, On the Use of the Hard-Rubber Bougie in Chronic Affections of the Eustachian Tube and the Middle Ear. Arch. Internat. de Laryngol, d' Otol, et de Rhinol, Vol. XV., 1902, pp. 81-87. M. cured 3 cases of O. M. C. C. by slow dilatation of the Eustachian tube by hard-rubber bougies.

McAuliffe, Geo., Dilatation and Stenosis of the Eustachian Tube. New York Eye and Ear Infirmary Reports Jan., 1898. Two cases, one of unusual dilatation and the other of stricture of the Eustachian Tubes.

Ménière, E., The Use of Rubber Bougies in the Treatment of Chronic Catarrhal Affections of the Eustachian Tubes and the Middle Ear. Arch. Internat. de Laryng. d' Otol. etc., XI., 1898, pp. 31-36. M. assumes that catarrh of the E. tube is the primary lesion which later causes middle ear changes. Uses bougies and recommends them. They are dipped in potassium iodide and iodine solution. He leaves them in place one half minute to one hour. In two cases not improved by regular catheterizations, hearing was much improved.

Ménière, E., De la dilatation intermittente et progressive de la Trompe d' Eustache. Franc. méd., I., 1889, pp. 445-448. (On the intermittent and progressive dilatation of Eustachian Tube). M. after employing bougies for fifteen years praises their use. Instead of withdrawing the tube he uses a method of his own; that is, he bends forward the patient's head forcing it to slide out of itself.

Ménière, E., Catheterization of the Eustachian Tube (reply to discussion), Gaz. des Hôpiteau, Vol. 59, 1886, p. 268. M. uses only silver catheters which he disinfects by keeping them in a vessel filled with alcohol. Before use, the catheter is exposed to an alcohol flame. It is then dipped in cold water and cleansed with a copper wire.

Ménière, E., On the use of Rubber Bougies in Chronic Catarrhal Affections of the Eustachian Tube and the Tympanum. Moscow International Conference, Arch. of Otol. XXVII., 1898, pp. 97, 98. "Chronic inflammation of the Eustachian tube is the most frequent cause of gradually progressive loss of hearing. In these cases, repeated insufflations of air often have no effect, though sometimes a marked improvement is produced by passing the bougies. The elastic bougies are the only serviceable ones; the end must be conical, and pass through a catheter of 1½—2 mm. breadth. The following solution is used: Iodine pur, iodide of potash, each one grain, distilled water 13 grains. The bougie may remain in position 1 to 60 minutes. Irritation is slight; occasionally burning in the naso-pharynx will be complained of."

Miot, C. Reflection sur l'obstruction de la trompe chez un diabetique. Remarks on the Obstruction of the Eustachian Tube in a Diabetic Patient. Société franc, d'otologie, April 15, 1887. M. states that cases of ear trouble in diabeties are caused by swelling of the Eustachian tube. They vary in deviation and intensity. Some are curable, in others the tube is permanently obstructed. M. believes the constant current allays the congestion of the tube and renders possible the introduction of bougies (and the application of the galvanic cautery.)

Michel, C. Neue Beobachtung über des Verhalten der Rachenmündung der Tuba und über die Thätigkeit der Muskulatur des Schlundkopfes. Berliner Klin. Wochensch., 1875, pp. 558-561. A patient, 20 years old, lost the entire nasal septum permitting direct observation. On swallowing, the posterior surface of the soft palate came into view pressing laterally between the cartilaginous projections of the Eustachian tubes and rising convexly against the posterior pharyngeal wall. Simultaneously the projections of the cartilages were elevated, their lower border approaching the median space of the pharynx; while, behind them, on the posterior pharyngeal wall appeared two projections rising from 1 to 1¼ cm. above the surface of the palate and having a smooth surface 1 cm. wide between. On forcible deglution this intermediate space disappeared and the mucous membrane presented additional folds. During phonation the appearance was much the same, except that a thick fold appeared on either side at the junction of the posterior and lateral pharyngeal walls. On sounding the vowel a, the palate was nearly flat; with e, i, o, u, it rose considerably above this

level. The anterior border of the Eustachian opening remained nearly motionless, except that below it there appeared a slight fold which was lost in the border of the palate, moving backward and forward during the act of swallowing. When at rest the Eustachian opening appeared like a furrow, the lower portion of which formed a triangle, the walls above lying in contact. The act of swallowing was accompanied by a wave-like motion on the floor of the orifice, then an elevation, the floor of the tube rising into the opening; and at the height of the act, the moment of greatest elevation of the floor, the furrow opened, presenting the appearance of a dark triangle, the apex of which was lost in a black line extending upward. During phonation the cartilaginous projection of the tube moves backward, and its lower border is elevated by the upward pressure of the floor. The orifice opens only during the singing of the high i or e, as with these vowels the palate is forcibly elevated and the floor of the Eustachian opening pressed upward. On sounding these vowels both the cartilage projection and the velum vibrate forcibly, and the transmission of these vibrations to the osseous portion of the tube and to the ear may explain in great measure the singing sound heard on sounding and holding the high i. The cracking sound heard on swallowing may also be explained by the movement of the cartilage of the tube. [This conclusion I believe is erroneous. It is caused by the drawing apart of the lips of the mouth of the tube].

Molinie, J., Defect of the Lips of the Eustachian Tube and Atresia of the Pharyngeal Tubal Ostium. Report of Trans. 7th Int. Otol. Cong. in Arch. of Otol., XXXIV., 1905, p. 327 (Also in Bull. de laryngol., otol. et rhinol., VII., 1904, p. 187). M. saw 2 cases of contraction of the naso-pharyngeal isthmus with atresia of tube. Both cases he thought due to too energetic use of galvano-caustic applications.

Moos, S., Klinik der Ohrenkrankheiten, Wien 1866. The folds in the lining mucous membrane of the Eustachian tube are most numerous at its lower portion and form a bulging just behind the pharyngeal orifice which aid in the closing of the tube.

Moos, S., A Preliminary Notice on the Anatomy and Physiology of the Eustachian Tube. Arch. Ophthal. and Otol., I., 1869, pp. 716-717. Believes tube is closed while at rest by an intumescense at the pharyngeal orifice.

Moos, S., The Histological Changes of the Eustachian Tube in Chronic Catarrh. (Trans. by Dr. A. N. Blodgett.) Arch. Ophthal. and Otol., V., 1876, pp. 542-560, pll. I. and II. A case treated for Eustachian tube stenosis, at intervals for 10 years, came to autopsy. Normal and pathological anatomy of the tubes described.

Moos, S., Beitrage zur Normalen und Pathologischen Anatomie und zur Physiologie der Eustachischen Röhre. Weisbaden, 1874, p. 53, pl. VI. The tube when at rest is closed at a point just behind the funnel-shaped end of the faucial opening and this closure extends through about two-fifths of the length of the canal. On the lower surface, or floor, of the tube the closure is effected by the longitudinal folds of mucous membrane which form a considerable prominence, really a valve of variable size. On the opposite surface of the canal, below the cartilaginous hook, in the lower portion of the canal, is another prominence of mucous membrane smaller than the other. These have their analogy in the lower animals. They probably facilitate the patescence of the canal by their unrolling. The cartilaginous "islands" of the tube are divided into five classes, the most important being those on the floor and sides of the tube. Those on the sides consist always of fibro-cartilage. They assume here the function of sesamoid bones in the tubal mechanism through their attachments.

Myles, R. C., Adhesions Connecting the Eustachian Tube to the Pharyngeal Wall above. Arch. of Otol., XXVI., 1897, pp. 322-323. Two cases reported in which there were adhesions connecting the Eustachian tube to the walls of the pharynx, forming a number of cavities (recesses?). The adhesions were torn with the finger with relief of symptoms.

Nicoladoni, C., Beobachtung am Lebenden uber die Bewegung der Tuba Eustachii. Monatschr. für Ohrenheilk Aug., 1875. A favorable opportunity for observing the movements of the Eustachian tube was presented by the performance of an operation on a tumor of the naso-pharynx by first removing the upper jaw. "Simultaneously with the contact of the soft palate with the posterior pharyngeal wall, its posterior surface being almost in line with the floor of the nose the medial portion of the tube, about one millimetre in height, began its movement while the lateral portion appeared to remain at rest. The movement, rather rapidly performed, consisted in an elevation for about three millimetres of the lower prominent edge of the medial portion which appeared

to be also drawn backward and slightly toward the medium line. At the same time the lower boundary of the fossa of Rosenmüller became sharply marked and projected into the median space, an arcus salpingeus, the apex of the tube, remained at rest." A bubble formed of blood serum formed over the orifice of the tube. At each act of swallowing this bubble sank into the depth of the Eustachian tube to reappear immediately on the completion of the act.

Peter, The Eustachian Tubes and Their Appendages in the Mammalia. Arch. für Microscop. Anat. XLIII., 1894, pp. 327-376.

Pierce, Norval H., On the Value of Electrolysis in the Eustachian Tube. Arch. of Otol., XXXI., 1902, pp. 289-296. A good anatomical demonstration of the tube. The conclusions of the writer are that (1.) in otosclerotic disease electrolysis is useless; (2.) in the great majority of cases of catarrhal disease, it has no advantage over other methods of treatment; (3) in a certain few cases where there is probably a soft exudate near the isthmus, it may be regarded as of some value.

Randall, B. A., The Prime Effect upon the Ear of Nasal Stenosis. Phila. Polyclinic, IV., 1895, p. 173.

Randall, B. A., The Technic and Value of Catheter Inflation of the Tympanum. Phila. Polyclinic, VII., 1898, pp. 551-552. R. expresses confidence in its use.

Randall, B. A., Clinical Anatomy of the Eustachian Tube. Laryngoscope, IX., 1900, p. 82. There is little variation in the topography of the surrounding parts. The back edge of the hard palate is practically unvarying. The lumen of the tube is a slit, usually collapsed and devoid of its "safety tube" at its inner third, while a valvelike fold in its bifurcated lower part serves with the drag of the relaxed palate, to insure its closure.

Ranke, H., Case of Malformation of the Ear. Sitsungsber d. Ges. f. Morphol. und Physiol. in Munich, No. 2, 1889, p. 68. The case examined post-mortem revealed the meatus ending in a blind tube. The tympanic cavity was entirely absent. The Eustachian tube was rudimentary and ended blindly.

Reitmann, Karl, On the Structure of the Cartilage of the Eustachian Tube in Man. Monats. für Ohrenheilk, XXXVIII., 1903, pp. 45-50. The cartilage of the Eustachian tube of the new-born is a typical reticular cartilage. In the adult

the elastic fibres surround the cartilage cells. Occasionally there are vascular channels in the cartilage which generally carry veins. The fatty degeneration of the cartilage, occasionally appearing, is regarded by the author as responsible for the fragmentation of the tubal cartilage."

Roaldes, A. W. de, Otological Pecularities of the Negro. Rev. de Laryngol. et d' Otol., XV., 1895, pp. 1169-1182. Among other differences noted, the mouths of the E. tubes are stated to be larger, the naso-pharynx much more spacious, deaf-mutism rarer.

Roure, M., On the Passage of Bougies in the Tubes in Cases of Dry Middle Ear Catarrh. Bull. de laryngol., otol., et rhinol., VII., 1904, p. 250. Uses a steel bougie and a modified catheter.

Royet, Adhesions of the Eustachian Tube to the Posterior Pharyngeal Wall as a Cause for Progressive Sclerosing Otitis and Symptoms of Vertigo. Archiv. internat. de Laryngol., d' otol., et de Rhinol., XVII., 1904, p. 371-397. The cause of progressing deafness is assigned by R. to the broad adhesions of the pharyngeal opening of the Eustachian tube to the posterior pharyngeal wall. After division of these adhesions with the finger the author believes he has observed cases of recovery, improvement or at least a bar to its progress.

Rumbold, Thos. F., Functions of the Eustachian Tube. St. Louis Medical and Surgical Journal, July 20 to Sept. 5, 1880.

Rumbold, Thos. M., Remarks on the Inflation of the Middle Ear. Laryngoscope, II., 1897, pp. 291-294. R. believes two objects are accomplished by inflation with the Politzer bag: (1.) removal of a plug of mucus from the tube of the middle ear cavity; (2.) restoration of the normal atmospheric pressure of the middle ear.

Schade, Migration of a Nail from the Naso-pharynx into the Middle Ear. Deutsche Med. Wochenschr., XXVIII., 1902, p. 796. Four years previously the patient extracted a nail from a box with his teeth. He swallowed the nail and suffered pain in his throat for some time. Attempts at extraction failed. Lately after a violent motion sudden pain occurred in the left ear and in three days the patient was able to extract the nail out of the ear. It was 12 mm. long, 1 mm. thick and bent in the middle. [There seems to be no proof that the nail passed through the tube. B.].

Schwalbe, G., Text-book of the Anatomy of the Organs of Special Sense. 2nd part, 2nd half, Eslanger, 1886. Schwalbe agrees that the greater portion of the cartilaginous tube is closed in a state of rest. It represents a closed vertical fissure, which every now and then is opened either by the simultaneous action of the tensor and levator palati or by the tensor alone. The orifice may also be opened by the tensor alone, independently of the act of swallowing. The levator is (thus) presumed to act by virtue of the fact that the belly of the muscle is thickened, in the region of the tube, by its contraction and so the walls are pressed apart. Contraction of the muscular fibres of the posterior-superior portions of the tube alone does not enlarge the orifice of the tube; this rather elongates the vertical fissure, smooths out the folds on the m. m. of the floor and thus fixes that portion of the tube wall.

Schwabach, D., On the Pathological Anatomy of Deaf-mutism. Arch. of Otology, XXXII., 1903, p. 378. The case described was that of a deaf mute who died of acute miliary tuberculosis. The mucous membrane of the bony Eustachian tube was very much thickened and infiltrated with small round cells in the superficial parts and in the deeper parts in the neighborhood of the tympanum.

Schumacher, H., Wratsch Gaseta, No. 19, 1902, in a paper, Ear Disease in Abdominal Typhoid, states that ear complications from typhoid are more common in children; that infection reaches T. by the way of the blood and Eustachian tube, and that syringing of the naso-pharynx is to be avoided because of the liability of forcing the passage of secretions through Eustachian tube to T.

Schwartze, Gehör-organ, pp. 103-104. A luxuriant tubercular growth surrounding the pharyngeal recess (fossa of Rosenmüller) on one side was observed. The recess itself was converted into a craterlike excavation twice the depth of its fellow.

Siebenmann, F., On the First Appearance of the Auditory Ossicles and the Tubo-tympanic Space in Man. Report Proc. 3rd meeting German Otolg. Soc., 1894. Arch. of Otology, XXIV., 1895, p. 56. "Examination of human embryos of the 3rd to 6th, 8th week showed that the blastem of the cartilaginous capsule appears in the 4th week, that of the annulus stapedialis in the 5th and that of the malleus and incus in the 6th week. Even at the earliest stage the blastem of the annulus stapedialis lies near the labyrinth

capsule as well as the dorsal end of the fore-cartilage of the second pharyngeal arch. The stapes is not of double origin. The space corresponding to the medial wall of the tympanic cavity exists at the first month as an undifferentiated portion of the pharyngeal cleft, a separation of the tubo-tympanic space taking place in the first half of the second month by the nearer approach to each other of the dorsal and ventral wall of the pharyngeal cleft and by the advancement of a solid mesodermic layer, closing the tympanic cavity below."

Siebenmann, F., Results of the Functional Examination in Cases of Pure Catarrh of the Eustachian Tubes. Trans. by E. B. Dench. Arch. of Otology, XXII., 1893, pp. 12-16. Bezold found 9 per cent. of pure tubal catarrh among his entire series of cases. Two isolated reports of Bezold treat of the symptoms of tubal Catarrh. In a large number of cases catheterization showed no secretion in the middle ear. Mt. was usually depressed but no signs of inflammation. On inflation the Mt. resumed its normal appearance and hearing was improved to a marked degree. Before inflation hearing distance for whisper was greatly diminished 10 to 500 cm. (normal distance 15 metres). In Weber's test the sound was referred to the affected ear. Weber-Schwabach test marked increase in bone conduction in affected ear. Rinne's test was positive in only two cases; in all others, negative. Upper tone limit was below normal. Lower tone limit was usually curtailed. Inflation produced an increased hearing distance. In fact, only cases showing marked improvement by the procedure were considered in this class of cases. Schwabach's test was only slightly altered. The results obtained by Rinne's test were shortened or reversed becoming positive in all but two cases. The upper tone limit remained unchanged in ½ the cases. The lower tone limit was increased. Bone conduction remains stronger after inflation. This latter phenomenon is regarded as due to the hyperaemia exxvacuo always present in tubal catarrh. In consequence of this hyperaemia there is likewise a rigidity of the annular ligament of the stapes, even after the aspiration position is corrected. This rigidity does not disappear for some time. It is possible to assume that the portion of the scala vestibuli lying near the oval window serves to affect the perception of the highest notes; that this part suffers from passive hyperaemia and that this cannot be removed immediately but only gradually.

Stenger, P., On the Etiology and Treatment of Sclerosis of the Middle Ear. Deutsche Med. Wochenschr., XXIX., 1903, pp. 513-514. The process is regarded as an inflammation originating in the nose and pharynx, thence extending through the Eustachian tube to the ear.

Stillson, Hamilton, Experiments on the Eustachian Tube by means of the Tongue Thrust Into the Naso-pharynx. Laryngoscope, Vol. III., 1897, pp. 38-47. The experiments of Hammerschlag (1st Aust. Otol. Cong.) are criticised. S. by means of the manometer shows that contrary to Hammerschlag's belief during the time the Eustachian tube is actually open throughout its length the Mt. moves extensively outward during expiration and inward during inspiration. S. is able to introduce his own tongue behind his palate and so, at will, to close the tubes completely with his tongue. On thus closing the tubes all motion of the Mt. ceases in both inspiration and expiration. (2.) With the mouth closed, i. e., with the Eustachian tubes as normal, the manometer shows the phenomenon mentioned by H. Now the index in inspiration moves outward; in expiration, inward. In breathing through the nose the excursions of the Mt. are more extensive than with mouth respiration. This same excursion of the membrana tympani takes place in the same way when the tongue pushes forcibly into the naso-pharynx and completely closes the Eustachian tubes. Likewise the motions synchronous with the heart beats occur whether the tongue closes the Eustachian tube or not. S. says it is therefore evident that the "respiratory" movements and pulsatory excursions have nothing to do with the rarefaction or compression of air in the tympanic cavity through air passing directly through the tube in normal respiration. S. thus concludes that the Eustachian tube is normally closed during deglutition. S. does not know what causes this reverse movement of the drum in normal respiration, but suggests that the cause is due to the increase of blood pressure in the head on inspiration and to lowered pressure on expiration. By noting the behavior of the pharyngeal mouths of the tubes with the aid of the tongue S. finds that in swallowing the pharyngeal portion of the tube is drawn up and pushed up so as to be tightly coapted to the end of the introduced catheter. This is chiefly accomplished by the constrictor muscle. Politzer's conclusion from experiments with the manometer are also regarded by S. as in error. S. believing that the increased

sound of a vibrating tuning fork held in front of the nose during the act of swallowing is due to condensation of the air in the tube and ear and claiming that pressure of the tongue into the mouths of the tubes completely closing them, produces a similar effect.

Stirling, Alex. W., Itching of the Auditory Meatus. Laryngoscope, VIII., 1900, p. 146. S. thinks itching of the meatus of the ear is sometimes caused by irritation from inflammation or irritating applications at the pharyngeal end of the Eustachian tubes.

Tansley, J. Oscroft, A Piece of Bougie in the Eustachian Tube. Laryngoscope, XIII., 1903, pp. 36-40. A bulbous point of a bougie was found in the mouth of the tube where it had broken off. The method of treatment is also disapproved of by the author.

Thomson, St. Clair, Approximation of the Remains of Luschka's Tonsil and the Eustachian Cushions. Laryngoscope, IX., 1900, p. 58. T. believes "Sinuses in the vault of the naso-pharynx" were nothing but depressions produced, as the title of his communication describes, by the approximation of the remains of Luschka's tonsil and the Eustachian cushions.

Truckinbrod, C., A Malformation of the Ear. Archiv. of Otology, XIV., 1885, pp. 128-132, pl. II. In this case of marked deformity, there existed complete closure of auditory canal, middle ear very small, rudimentary ossicles. No trace of a drum membrane was found, solid bone being found in its situation. Eustachian tube was present. The tube had a large, quite uniform diameter throughout its length. Its vertical diameter at its opening into the tympanic cavity was 4 mm. Its length 2.4 cm., 1.4 cm. of which belongs to the bony tube. No isthmus tubae proper was found, its diameter at this situation was 2 mm. The tympanic cavity appeared as a considerable expansion of the extremity of the tube.

Uffenorde, W., The Auscultation of the Middle Ear. Arch. für Ohrenh., LXVI., 1902, p. 1. No diagnosis can be made by means of the distinctions of the sound, as to whether it is due to tubal or middle ear condition, as it may meet an obstruction which may absorb or reflect sound waves. (2.) The blowing noise comes from the end of the catheter and the tube, the middle ear acting as a resonator.

(3.) No conclusion as to the consistency of the secretion can be drawn from the musical character of the sound. (4.) Râles from the middle ear have a deeper note and a secondary sound due to the secretion falling backward. The tubal râles are higher and fewer. (5.) If no auscultation sound is heard in a moist catarrh, the obstruction is usually in the tube. (6.) Under ordinary conditions most of the secretion leaves the middle ear via the Eustachian tube. (7.) A whistling noise indicates secretion but gives no clue as to the size of perforation. In two cases the presence of crepitant râles during catheterization suggested the presence of an exudate in the middle ear. On incising the membrane no fluid was found. U. then investigated the subject of the generally accepted opinion regarding exudates of the tympanum. He used a fresh cadaver and disarticulated temporal bones. He finds it impossible to determine with the otoscope whether the sounds heard are near to, or far from, the ear of the observer. A vesicular murmur is produced principally at the end of the catheter and at the walls of the tube. The tympanum serves as a resonator. The musical character of the crepitant râle does not inform us as to the character of the secretion. Crepitant râles produced in the tympanum is regarded as due simply to changes in position of the secretion. This accounts for an unusual intensity of sound and by a musically lower note. The lower after-murmur is due to the secretions falling back into its former position. Tubal noises are higher and less intense corresponding to the smaller amount. The bursting of air bubbles can only explain a part of the secondary noises. If there is moist catarrh present and an auscultation murmur is perceived the obstruction is probably tubal [!] Conditions being favorable, removal of the discharge from the tympanum is probable of accomplishment through the tube into the epipharnyx. If the amount is small its evacuation is of importance. In the presence of a perforation, whistling murmur denotes secretion but it is not necessarily related to the size of the perforation. A perforation murmur may occur with an entire absence of the drum

Urbantschitsch, V., Bougieing the Eustachian Tubes in Chronic Disease of the Middle Ear, Especially in Chronic Middle Ear Catarrh. Wiener Med. Presse, Vol. 24, 1883, pp. 48-73. After chronic middle ear catarrh there often remains a narrowing

of the tube, especially at the isthmus, though the entrance of air is not much interfered with. He regularly uses bougies, on examination, in diagnosing O. M. C. C. employing the French bulbous bougies. He advocates the dilatation of all tubes in cases of impaired hearing and subjective noises in which a bougie 1⅓ mm. diameter cannot enter the bony portion or where it enters with great difficulty. Improvement takes place he believes by a reflex influence generated by the irritation of the sensitive twigs of the trigeminus, especially the tubal branches. This influence he thinks extends to all the senses and of course to the ear. He employs the bougies in chronic suppuration when associated with narrowing of the isthmus tubae.'

Urbantschitsch, Ernst., Vibratory Massage of the Eustachian Tube in Chronic Middle Ear Catarrh. Monatsch. für Ohren., XXXVII., 1903, pp. 89-96. The thin celluloid bougie is introduced to the isthmus of the tube; then external massage is employed by means of a pad set in motion by a motor, and continued four minutes. U. thinks circulation is improved in tensor tympani and tubal muscles and in middle ear. He reports improvement of subjective noises.

Urbantschitsch, V., An Apparatus for Friction Massage of the Ear or Eustachian Tube. Monatsch. f. Ohren., XXXVI., 1902, pp. 455-467. An apparatus is constructed which has two electric magnets on a rod, arranged to convey various movements to the mucous membrane of the mouth of the tube and the naso-pharynx.

Vajda, V., Syphilitische Infection der Tuba Eustachii. Bericht der Klinik für Syphilis des K. K. Allgemeinen Krankenhauses, Wien, 1875. A case of syphilitic infection at the mouth of the tube from an infected Eustachian catheter.

Valentin, Ad., The Cystoscopic Examination of the Naso-pharynx or Salpingoscopy. Frankel's Arch. für Laryngol., XIII., 1903, pp. 410-420, Taf. XXII. The condition of the tubal ostium, upper wall of the naso-pharynx and the posterior surfaces of the velum are rendered visible by a cystoscope-like apparatus introduced through the nose.

Vali, On Objective Noises of the Ear. Arch. für Ohrenheilk., LXVI., 1906, p. 104. Objective noises usually develop from an abnormal circulation or tonic and clonic contractions of the muscles of the tympanum and in the pharynx. A case synchronous with pulse was not arrested by pressure on

the carotid but was stopped by depression of the tongue, by elevation of the soft palate and by catheterizing the tube. Regarded as due to clonic contractions of tensors and palate muscles.

Voltolini, R., Two Peculiar Ear Diseases. Monatschr. für Ohrenheilk, XVII., 1883, pp. 1-6. A twenty-year-old patient had for five years sensations of sudden valvelike closures of the ears lasting for some time. At these times, examination revealed a thin atrophic Mt., bulging outward and containing frothy mucus. By negative Valsalva the Mt.. was made to withdraw against the inner T. wall. By slightly swallowing the first condition reappeared. Diagnosis: Dilatation of the Eustachian tube with exudation, confirmed by insertion of catgut bougies. Respiratory vibration of the Mt. was noted. On pronunciation of the letter R, a fluttering vibration was developed.

Voltolini, R., On the Catheterization of the Eustachian Tube in Cases of Palatal Fissure, and the Inspection of the Nasal Cavity from in front while it is being illumniated from behind. Monats. für Ohrenheilk., XVIII., 1884, pp. 7-8. In a patient with a cleft of both soft and hard palate, the posterior lip of the tube, but not its mouth, was visible through the oral cavity.

Warnecke, G., Simple and Vibratory Catheterization with a Current of Carbonic Acid Gas. Archiv. für Ohrenheilk., LXVIII., 1904, pp. 227-232. The gas is led by a tube to the catheter. The intermittent current is thought more active than the continuous.

White, F., Complete Deafness for Twenty-four Years from Eustachian Closure. Perfect recovery after a course of Politzeration. Brit. Med. Journal, March 2, 1895.

Wolf, Oscar, Review of Hartmann's "Experimentelle Studien ueber die Function der Eustachischen Röhre." Archives of Otology, VIII.,1879, pp. 209-211. He cites Hartmann's experiment showing that a slight pressure from within the middle ear only is necessary to overcome the closure of the tube, as a support to his theory that the Eustachian tube is protective by furnishing an outlet for sound waves. Loud sounds would, he thinks, produce grave changes in the ear without it.

Wolf, Oscar, Sprahe und Ohr., p. 240. W. states his experimental proof that the tube is for the outlet of sound—

a protective mechanism. It permits the sound waves to escape from the rigid walls of the osseous tympanum into the external air.

Yankauer, Sidney, Eustachian Sounds. Archives of Otology, XXXV., 1906, p. 247. The sounds described and here recommended by Y. are made of catgut surrounded by a resin. They bear sterilizing. They are not bulb-pointed. They are ringed near the proximal end for convenience in determining the distance introduced.

Zaufal, E., Die Plica Salpingopharyngea. Prague Med. Wochenschrift, Vol. IV., 1879, pp. 217-227. Calls this fold the ridge-fold. He observes that it projects forward in (swallowing) movements as a sharply defined medial fold of variable thickness. It extends 3—5 centimeters downward and backward as a direct continuation of the tubal convolution. When the head is bent backward it can be directly observed with the aid of an uvula retractor.

Zaufal, E., Die Plica Salpingopharyngea. Arch. für Ohrenheilk., Vol. XV., 1879-80, pp. 96-144. The various diseases affecting the fold are described. It is the seat of pronounced swelling and tumefaction. Cystoid follicles may develop in it which tend to obstruct the mouth of the tube.

Zuckerkandl, E., Zur Anatomie und Physiologie der Tuba Eustachiana. Monatsch. für Ohrenheilk., VII., 1873, pp. 125-145. Bundles of fibres, tendinous and elastic, pass from the pharyngeal end of the tube to connective tissue of the levator palati, the muscles of the pharynx and soft palate. These aid in drawing open and closing the orifice as different muscles are contracted.

Zuckerkandl, E., Anatomische Notiz über die Tuba Eustachiana eines Elephas Indicus. Monatschr. für Ohrenheilk., IX., 1875. There is no projection on the pharyngeal wall to mark the opening of the Eustachian tube in this animal, and it is discoverable only with some difficulty. It is almost exactly vertical. The ostium pharyngeam possesses no distinct cartilaginous boundary and appears as a small, irregular slit, the thick lateral wall longer than the membranous, median wall. The tubal cartilage is thicker above, assumes the form of an almost complete cylinder nearly surrounding the tube at its median portion. The tube is fixed to the skull by a comparatively slender basilar fibro-cartilage.

Zuckerkandl, E., Contributions to the Anatomy of the Organ of Hearing. Reviewed in Arch. of Otology, XIV., 1885, p. 211. On dissection, a small piece of bone, the size of a hemp seed, was found in the anterior wall of the Eustachian tube, the pharyngeal orifice being otherwise normal. The spicule was firmly adherent to the mucous membrane and Z. regards it as a circumscribed ossification of the cartilage. (Moos has published similar findings). Accessory cartilaginous plates in the floor of the Eustachian tube, in the pharyngeal prominences, the lateral walls, in the ligaments connecting the cartilaginous portion of the tube with the vault of the pharynx are so commonly found as to be considered normal.

Zuckerkandl, E., On the Eustachian Tube of the Ant-Eater. Monatsch. für Ohrenheilk, XXXVIII., 1904, pp. 1-7. Z. differs from the view of Hyrtl (1845) that the bony tube is absent in Myrmoscophaga jubata. Z. finds a bony tube 15 cm. long without any cartilaginous fundament attached to the margin of an opening in the temporal bone by which it communicates with the tympanum. Z. thinks Hyrtl mistook this opening for the carotid foramen.

Zuckerkandl, E., On the Anatomy of the Eustachian Tube. Monat. f. Ohrenheil., XL., 1906, pp. 1-11, etc. In these papers Z. gives results of his studies of the comparative anatomical characteristics of this region. The greatest differences are in the structures of the tubal walls, especially of the median walls. The lateral walls are approximately uniform, and usually fibrous. The median walls show varieties from fibrous to cartilaginous. In the lower forms of vertebrates the median walls are usually fibrous showing that the primitive tube was represented by a fibrous tube.

Zuckerkandl, E., A Contribution to the Comparative Anatomy of the Eustachian Tube. Arch. f. Ohrenheilk., XXXIII., 1886, pp. 201-213. The Eustachian tube of the Ornithorhynchus paradoxus or Duck-billed Platypus, is not tube-shaped but is represented by a simple fissure, which connects the tympanic cavity with the slightly pouched pharynx. All other mammals examined have a tube-shaped structure. This animal thus resembles in this structure the amphibia, the batrachia in general exhibiting a similar connection between the ear and the pharynx.

Zuckerkandl, E., The Eustachian Tube of the Tapir and Rhinoceros. Arch. f. Ohrenheilk., XXI., 1884, pp. 222-232. The Eustachian tubes of the tapir are remarkable by reason

of a smooth, narrow-edged air-sac, the size of a hen's egg, situated about 8 mm. behind the pharyngeal opening of the tube extending upwards 45 mm. connecting with the cartilaginous portion of the tube and reaching posteriorily 22 mm. beyond the auditory organ. The comparatively small amount of hyaline cartilage in the tube is placed at the superior wall, and projecting downward medially and laterally form here a sort of groove. The medial wall contains fibrous cartilage as support. The levator palati is pushed outward by the air-sac. The membranous lining of the tube presents numerous ridges, especially on its floor. It contained no acinous glands but adenoid tissue in the shape of follicles were found. The air-sacs resemble those found in the horse. The Eustachian tubes of the rhinoceros were found in the adult to be 89 mm. long. In the neighborhood of the junction with the bony tube a vascular network exists formed by arterial twigs from the internal carotid and distributed into the cavernous sinus. The hyaline cartilage has the typical shepherd's crook shape. The narrowest portion of the tube is near the middle of its length. Bundles of fibrous tissue containing some hyaline cartilage cells strengthened the cartilaginous tube. The mucous lining of the tube was paved with ciliabed epithelium; contained acinous glands in its deep layers and adenoid tissue superficially.